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Investigating white matter hyperintensities in a multicenter COVID-19 study using 7T MRI

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Investigating white matter hyperintensities in a multicenter COVID-19 study using 7T MRI

Monday, July 17, 2023

1:00 AM - 1:45 AM

Hall 11 (RAI Amsterdam Convention Centre)

Theme

Biomarkers

Abstract

Background:

Emerging evidence indicates that COVID-19 can negatively impact patient's brain health (Douaud et al., 2022) (Cecchetti et al., 2022). Common clinical symptoms include brain fog, headaches, difficulty concentrating, and loss of sense of smell or taste. Some studies suggest that SARS-CoV-2 infection can damage the blood brain barrier either directly or through immune-inflammatory mechanisms (Zhang, et al. 2021). White matter hyperintensities (WMH) are imaging biomarkers of brain vascular or inflammatory injury. We investigated the association between severity of COVID-19 infection and burden of white matter hyperintensity volumes within a diverse multi-nation, multi-racial cohort using 7 Tesla (7T) MRI that can detect more subtle injury than conventional 1.5 or 3T MRI.

Method:

Participants were recruited at 4 sites: Pittsburgh, San Antonio and Houston, USA, and Nottingham, UK. To date, we have scanned and included the following participants in our analysis (Table 1). Detailed cognitive, neurological, mood and functional assessments and high-resolution MRI scans were collected. Subsequent WMH segmentation was performed using our in-house built deep learning based model (Figure 1). All segmentations were visually inspected and manually corrected before statistical analysis. Normalized WMH is calculated as a ratio of the WMH volume and the intracranial volume (WMH/ICV). Imaging data for an additional 36 age-matched controls were retrieved from the 7 Tesla Bioengineering Research Program (7TBRP) imaging bank at Pittsburgh.

Result:

Figure 1 shows the WMH segmentation outputs from our deep learning based model on images acquired at the 3 sites. Our Linear regression models along with our non-parametric Kruskal-Wallis test result suggests that compared to mild COVID cases and healthy control, COVID infected individuals that were ICU admitted show elevated WMH burden (Figure 2).

Conclusion:

Our results demonstrate that white matter hyperintensity volumes were higher among patients who had severe acute COVID infection that required ICU admission, compared to healthy age-matched controls. In contrast, no difference in white matter burden was observed in patients with mild COVID infection compared to healthy controls. Additional data (both cross-sectional and longitudinal), including more sensitive MRI measures is being collected to define the full spectrum of brain injury associated with sequelae of COVID infection.

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